

LISTS OF SPECIES

Mammals, Birds and Reptiles in Balbina reservoir, state of Amazonas, Brazil.

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Abstract: The construction of hydroelectric power stations can affect the fauna, including the adaptation to the new lentic conditions, and may lead to the disappearance of some species and the colonization of others. Usually, there is a lack of information in the post-flooding phases. The present study is a preliminary qualitative survey of mammals, birds, and reptiles in the influenced area of the Balbina hydroelectric dam (01°55' S, 59°29' W). Species records were made during field trips to the reservoir with no group specific methods. The conservation status of the identified species followed the classification adopted by IUCN. Twenty-two mammals (one endangered – EN), forty-two birds and six reptiles (one vulnerable – VU) were identified. Although the list presented here is preliminary, if appropriately complemented it can be used to understand the effects of hydroelectric dams on the Amazonian fauna.

Introduction

The construction of large hydroelectric power stations can affect the fauna by large impacts on the aquatic and terrestrial environments. Wild animals are intimately related with their surroundings and can be strongly affected by drastic alterations in the habitats. Gribel (1993) emphasizes the matter regarding the drastic impact on the wild fauna caused by the forest flooding, and raises the question about what to do with the animals that live in the areas that will be flooded. The habitat fragmentation and the species isolation on small islands can result, in many cases, in the disappearance of many of them due to the genetic isolation which they will be submitted to. However, the problem becomes even more aggravated due to the lack of studies in the subsequent phases of the flooding, when the formation and stabilization of the lake occur. The flooding of Balbina's reservoir began in 1987 and the lake reached its operational stage at the 50.6 m level in 1989 (Fearnside 1990). Occasional information concerning the occurrence of Giant Otters in Balbina Lake 15 years after its formation lead to the development of a project entitled "Social organization, behavior, and diet of the giant otter (*Pteronura brasiliensis*) in the influenced area of Balbina hydroelectric power station" (Rosas and de-Mattos 2003a; 2003b; Rosas

et al. 2007) by the researchers of the *Laboratório de Mamíferos Aquáticos* of the *Instituto Nacional de Pesquisas da Amazônia* (LMA/INPA). Due to the lack of information about the fauna that currently inhabits the Balbina reservoir, and taking advantage of the researchers' presence in the lake during the Giant Otter Project expeditions, the present study aimed to accomplish a preliminary qualitative survey, recording the mammals, birds, and reptiles (Testudines, Crocodylia, and Squamata) in the influenced area of the Balbina reservoir. The information presented here, although not definitive, provides qualitative data on the fauna that currently inhabits this reservoir area.

Material and methods

The Balbina dam (01°55' S, 59°29' W) is located on the Uatumã River, a tributary of the left margin of the Amazon River, in the municipality of Presidente Figueiredo, state of Amazonas, 150 km in a straight line from Manaus (Figure 1). The lake covers a total of 4,437.63 km² (PROJETO FUNCATE/INPE/ANEEL 2000), and contains 3,299 islands (Rosas and de-Mattos 2003b). The reservoir includes part of the Uatumã Biological Reserve (ReBio Uatumã) and part of the Waimiri-Atroari Indigenous Reserve.

LISTS OF SPECIES

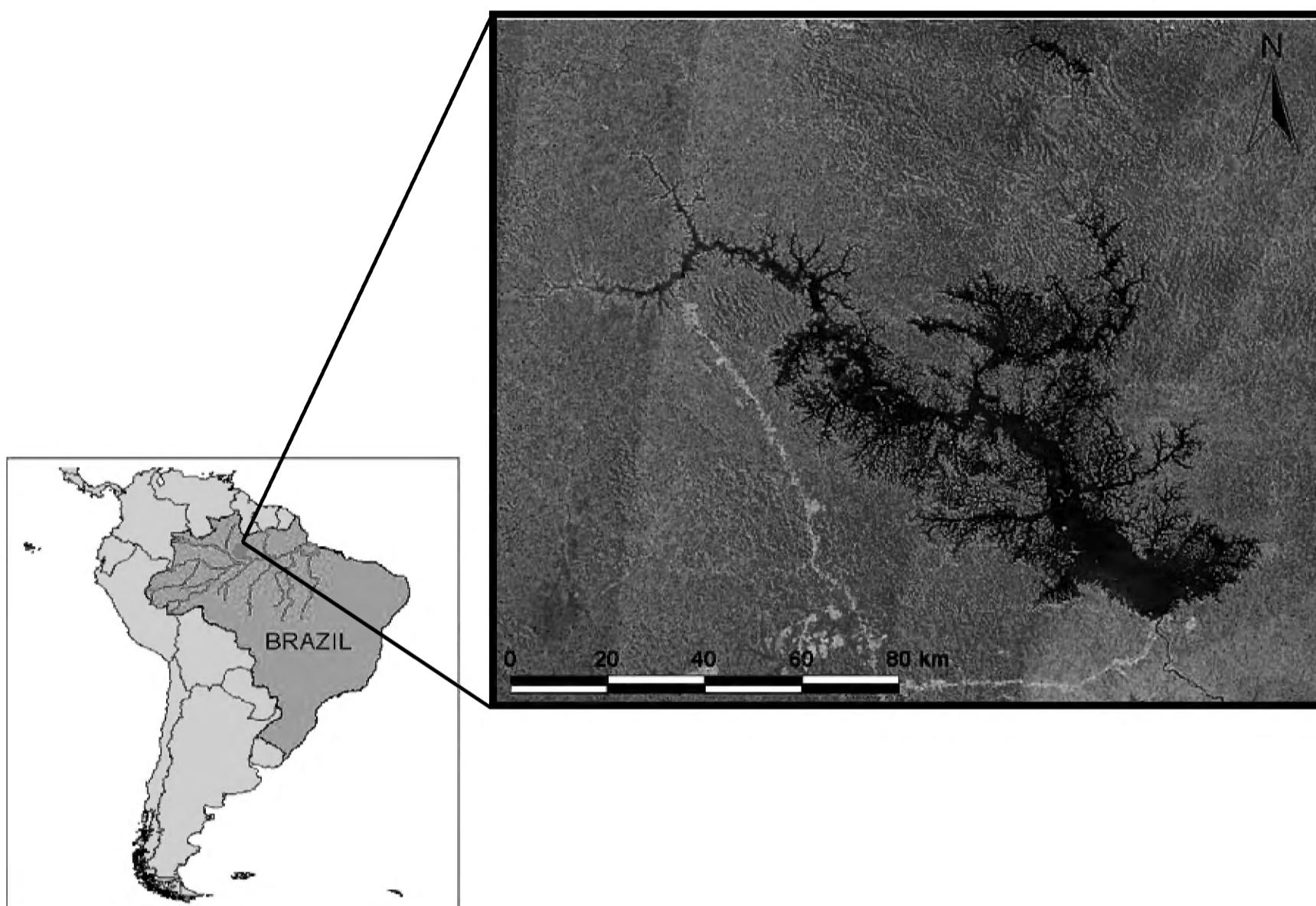


Figure 1. Location of sample area: Balbina Lake in Central Amazon, northern Brazil.

During the six years of the Giant Otter Project (2001 to 2007), records of mammals, birds, and reptiles (Testudines, Crocodylia, and Squamata) were made circumstantially during trips to Balbina Lake accomplished every two months, with duration of seven to ten days. Although nowadays the study area is a huge dendritic lake, the visited areas included sections of what was originally part of the Uatumã River, Pitinga River (tributary of the left margin of the Uatumã River), Pitinguinha River (tributary of the right margin of the Pitinga River), and creeks of the drainage basins of these rivers. The total sampled area corresponded to about 500 km². Most of the sampled area was located inside the Uatumã biological reserve limits. The study was carried out using an aluminum boat with a 40 Hp outboard engine. Most of the records were made between 05:00 and 18:30 h. However, two species could be identified at night by vocalizations (the Red Howler Monkey *Alouatta seniculus* and the

Little Chachalaca *Ortalis motmot*; Tables 1 and 2). It is important to point out that the records were made during the Giant Otter Project's regular activities, and we rarely went into the forest to survey animals other than Giant Otters. However, whenever a visual contact was established with any other species, the identification was confirmed by using binoculars and/or acoustic records, and the species' name, date, time, and sighted place were recorded (geographical coordinates obtained by GPS). Whenever possible, the observed species were filmed and/or photographed for subsequent confirmation of the identification. Nevertheless, since we did not apply a species-specific methodology, a conservative criterion was adopted and only the species that were effectively seen and/or acoustically registered were included in the records. The species' conservation status was based on the IUCN (2007) classification.

LISTS OF SPECIES

Results and discussion

A total of 70 mammal, bird, and reptile species were recorded in the influenced area of Balbina reservoir. We identified 22 mammal species (one

endangered – EN) (Table 1), 42 bird species (Table 2), and six reptiles (one classified as vulnerable – VU) (Table 3).

Table 1. Mammals recorded in Balbina reservoir and conservation status according to IUCN (2007). EN, endangered; VU, vulnerable; NT, near threatened; LC, least concern; LR/LC, lower risk/least concern; DD, data deficient; and NL, not listed.

| Order | Family | Scientific name | Common name | IUCN |
|--------------------------------|-----------------|----------------------------------|--------------------------|-------|
| Artiodactyla | Tayassuidae | <i>Tayassu pecari</i> | White-Lipped Peccary | LR/LC |
| | | <i>Tayassu tajacu</i> | Collared Peccary | NL |
| Carnivora | Felidae | <i>Mazama americana</i> | Red Brocket Deer | DD |
| | | <i>Puma concolor</i> | Puma, Mountain Lion | NT |
| | | <i>Leopardus</i> sp. | Wild Cat | -- |
| | | <i>Panthera onca</i> | Jaguar | NT |
| | Mustelidae | <i>Eira barbara</i> | Tayra | LR/LC |
| | | <i>Lontra longicaudis</i> | Neotropical Otter | DD |
| | | <i>Pteronura brasiliensis</i> | Giant Otter | EN |
| Cetacea | Iniidae | <i>Inia geoffrensis</i> | Pink River Dolphin, Boto | VU |
| Chiroptera | Emballonuridae | <i>Rhynchonycteris naso</i> | Long-Nosed Bat | LR/LC |
| Perissodactyla | Tapiridae | <i>Tapirus terrestris</i> | Brazilian Tapir | VU |
| Primates | Atelidae | <i>Alouatta seniculus</i> | Red Howler Monkey | LC |
| | | <i>Ateles paniscus</i> | Black Spider Monkey | LC |
| | Callitrichidae | <i>Saguinus midas</i> | Golden-Handed Tamarin | LC |
| | | <i>Cebus apella</i> | Brown Capuchin Monkey | LC |
| | | <i>Saimiri sciureus</i> | Common Squirrel Monkey | LC |
| | | <i>Chiropotes sagulatus</i> | Brown Bearded Saki | NL |
| | Pitheciidae | <i>Pithecia pithecia</i> | Guianian Saki | LC |
| | | <i>Dasyprocta leporina</i> | Red-Rumped Agouti | LR/LC |
| Rodentia | Hydrochaeridae | <i>Hydrochaeris hydrochaeris</i> | Capybara | LR/LC |
| Xenarthra | Myrmecophagidae | <i>Myrmecophaga tridactyla</i> | Giant Anteater | NT |
| Total number of mammal species | | | | 22 |

During the fauna survey conducted prior to the damming, 90 mammal species were registered by the report produced by ELETRONORTE/CNPq/INPA (*Preservação e utilização científica da fauna. Relatório setorial. Julho-dezembro/1985*, unpublished data). In the present study, the occurrence of only 22 species for this same group

were recorded. This difference is probably related to the methods applied in this study. The species listed here were recorded occasionally, without applying any specific method, with concentrated sampling effort mainly during the day and limited to the margins of the creeks and rivers. Several mammals have nocturnal habits (e.g. bats and

LISTS OF SPECIES

small rodents) and many of them use the interior of the forest and canopy stratum, thereby significantly reducing the chances of being sighted by us. Additionally, the fauna survey during the pre-damming phase also sampled above and below the dam.

Although the Tucuxi Dolphin (*Sotalia fluviatilis*) is included in the ReBio Uatumã management plan - phase 1 list (ELETRONORTE/IBAMA - *Reserva Biológica do Uatumã. Plano de Manejo Fase 1. Documento de Informações Básicas. Brasília, Novembro/1996*, unpublished data), we never observed this species in the reservoir. According to the reports conducted before damming, the occurrence of the Tucuxi in the area is mentioned as "probable", but this dolphin was not recorded in the lake on that occasion either. This dolphin species usually uses open waters, occurs in groups of up to six individuals and frequently displays surface behavior (da-Silva and Best 1996). Therefore, if the Tucuxi does occur in Balbina Lake, it would have already been observed by us during the six years of the Giant Otter Project, whose team members have large experience with Amazonian aquatic mammals. It is very probable that *S. fluviatilis* was included in the ReBio Uatumã management plan due to mistaken identification. This species can be easily confused with young Pink Dolphins (*Inia geoffrensis*) even by biologists. The total length of juveniles of *I. geoffrensis* is similar to that of the Tucuxi Dolphin and juvenile Pink Dolphins are completely gray, which could cause the confusion.

It is interesting to note that in 1987, when the floodgates of Balbina were closed, the researchers of LMA/INPA caught, marked, and released nine adult Pink Dolphins in the reservoir under formation, which had become confined in small ponds just below the dam (V. M. F. da Silva, pers. comm.). This species already occurred above the dam and even today can be frequently seen in the lake. The dolphins marked in 1987 received a colored plastic tag attached to their dorsal fin. These tags are known to "migrate" and fall off the animal in a period of approximately one year due to water friction. This "migration" leaves a scar in the dolphins' fin that can be easily identified.

During the last six years, we recorded at least three times Pink Dolphins with that kind of scar in their dorsal fins (February 2003, February 2004, and April 2006).

Although the presence of Amazonian Manatees (*Trichechus inunguis*) was not recorded above the dam during the fauna survey carried out before damming the Uatumã River, the occurrence of this species was mentioned as being possible but in reduced numbers. However, during the six years of the Giant Otter Project, this species was never seen in the reservoir, neither through direct observations nor through traces (feces or chewed up plants). Nonetheless, the Amazonian Manatee is a species that is very difficult to be observed in the wild and unlike the Tucuxi Dolphin, it never exposes more than its nostrils out of the water when breathing (Rosas and Pimentel 2001). Therefore, if it occurs in reduced numbers in the area, it will be extremely difficult to be seen, and one cannot exclude the possibility that this species has never occurred in the lake.

According to the unpublished reports conducted before damming, the Red Howler Monkey (*Alouatta seniculus*) was the most abundant species, followed by the Brown Capuchin Monkey (*Cebus apella*), and the Golden-Handed Tamarin (*Saguinus midas*). In the surveys conducted by us, no abundance estimates were performed. Therefore, comparisons concerning species abundance, or number of individuals of a taxon in an area, population, or community, were avoided. However, *Alouatta seniculus* was very frequently seen and heard (visual and acoustic records), while *Cebus apella* was frequently seen.

At least one mammal species that is classified by IUCN (2007) as endangered (EN) is currently present in Balbina Lake: the Giant Otter (*Pteronura brasiliensis*). Despite the impacts caused by the damming process, this species apparently lives in stable populations. Nevertheless, additional medium and long term studies are necessary in order to obtain better information regarding the viability of these populations.

LISTS OF SPECIES

Table 2. Birds recorded in Balbina reservoir and conservation status according to IUCN (2007). LC, least concern; and NL, not listed.

| Order | Family | Scientific name | Common name | IUCN |
|------------------------------|----------------|-------------------------------|------------------------------|------|
| Anseriformes | Anatidae | <i>Cairina moschata</i> | Muscovy Duck | LC |
| Caprimulgiformes | Caprimulgidae | <i>Chordeiles</i> sp. | Nighthawk | LC |
| | Nyctibiidae | <i>Nyctibius</i> sp. | Potoo | LC |
| Charadriiformes | Jacanidae | <i>Jacana jacana</i> | Wattled Jacana | LC |
| Ciconiiformes | Ardeidae | <i>Ardea cocoi</i> | White-Necked Heron | LC |
| | | <i>Butorides striatus</i> | Striated Heron | LC |
| | | <i>Ardea alba</i> | Great Egret | NL |
| | | <i>Pilherodius pileatus</i> | Capped Heron | LC |
| | | <i>Tigrisoma lineatum</i> | Rufescent Tiger-Heron | LC |
| | Ciconiidae | <i>Mycteria americana</i> | Wood Stork | LC |
| Coraciiformes | Alcedinidae | <i>Ceryle torquatus</i> | Ringed Kingfisher | LC |
| | | <i>Chloroceryle americana</i> | Green Kingfisher | LC |
| | | <i>Chloroceryle amazona</i> | Amazon Kingfisher | LC |
| | | <i>Chloroceryle inda</i> | Green-and-Rufous Kingfisher | LC |
| | | <i>Chloroceryle aenea</i> | American Pygmy Kingfisher | LC |
| Cuculiformes | Cuculidae | <i>Crotophaga ani</i> | Smooth-Billed Ani | LC |
| | | <i>Crotophaga major</i> | Greater Ani | LC |
| Falconiformes | Cathartidae | <i>Coragyps atratus</i> | Black Vulture | LC |
| | | <i>Cathartes aura</i> | Turkey Vulture | LC |
| | Falconidae | <i>Cathartes burrovianus</i> | Lesser-Yellow-Headed Vulture | LC |
| | | <i>Sarcoramphus papa</i> | King Vulture | LC |
| Galliformes | Cracidae | <i>Falco rufigularis</i> | Bat Falcon | LC |
| | | <i>Crax alector</i> | Black Curassow | LC |
| | | <i>Mitu tuberosa</i> | Razor-Billed Curassow | LC |
| | | <i>Ortalis motmot</i> | Little Chachalaca | LC |
| | | <i>Pipile cumanensis</i> | Blue-Throated Piping-Guan | LC |
| Gruiformes | Opisthocomidae | <i>Opisthocomus hoazin</i> * | Hoatzin | LC |
| | Psophiidae | <i>Psophia crepitans</i> * | Gray-Winged Trumpeter | LC |
| Passeriformes | Cotingidae | <i>Lipaugus vociferans</i> | Screaming Pihas | LC |
| | Emberizidae | <i>Paroaria gularis</i> | Red-Capped Cardinal | LC |
| | Icteridae | <i>Cacicus cela</i> | Yellow-Rumped Cacique | LC |
| Pelecaniformes | Anhingidae | <i>Anhinga anhinga</i> | Anhinga | LC |
| Piciformes | Picidae | <i>Celeus elegans</i> | Chestnut Woodpecker | LC |
| | Ranphastidae | <i>Dryocopus lineatus</i> ** | Lineated Woodpecker | LC |
| Psittaciformes | Psittacidae | <i>Ramphastos tucanus</i> | Toucan | LC |
| | | <i>Pteroglossus aracari</i> | Aracari | LC |
| | | <i>Ara arauana</i> | Blue-and-Yellow Macaw | NL |
| | | <i>Ara macao</i> | Scarlet Macaw | LC |
| | | <i>Ara manilata</i> | Red-Bellied Macaw | LC |
| | | <i>Pionus menstruus</i> | Blue-Headed Parrot | LC |
| Trochiliformes | Trochilidae | <i>Amazilia</i> sp. | Hummingbird | -- |
| Trogoniformes | Trogonidae | <i>Trogon</i> sp. | Trogon | -- |
| Total number of bird species | | | | 42 |

* Species recorded by Biological Reserve rangers and/or boat skippers working in the study area.

** Species not recorded in surveys previous to the damming.

LISTS OF SPECIES

Birds are the most well-known group among the vertebrates (Develey 2003). They are extremely diverse, with more than 9,000 different species in the world (de-Schauensee and Phelps 1978). A total of 243 bird species were recorded before damming, of which 157 species were identified close to the dam working site, on the northern side of the Uatumã River, in a period of five days (ELETRO NORTE/CNPq/INPA – *Preservação e utilização científica da fauna. Relatório setorial. Julho-dezembro/1985*, unpublished data).

A considerably low number of birds, only 46 species, was recorded in the current study. However, among them, *Dryocopus lineatus* was not recorded in previous surveys conducted before damming the Uatumã River. About 94.5 % of the birds recorded by us were observed in open areas or close to the river margins. Nevertheless, in the same way as for the mammals, it is likely that among the birds that use the interior of the forest, some species with a certain degree of threat could be found.

Table 3. Reptiles recorded in Balbina reservoir and conservation status according to IUCN (2007). VU, vulnerable; LR/CD, lower risk/conservation dependent; LR/LC, lower risk/least concern; and NL, not listed.

| Order | Family | Scientific name | Common name | IUCN |
|-----------------------------------|----------------|------------------------------|------------------------------------|-------|
| Testudines | Podocnemididae | <i>Podocnemis expansa</i> | Giant South American River Turtle | LR/CD |
| | | <i>Podocnemis unifilis</i> * | Yellow-Spotted Amazon River Turtle | VU |
| Crocodylia | Alligatoridae | <i>Caiman crocodilus</i> | Spectacled Caiman | LR/LC |
| | | <i>Melanosuchus niger</i> ** | Black Caiman | LR/CD |
| Squamata | Boidae | <i>Eunectes murinus</i> | Anaconda | NL |
| | Teiidae | <i>Tupinambis teguixin</i> | Tegu | NL |
| Total number of reptilian species | | | | 6 |

* Species not seen, but captured by Chelonian specialists working in Balbina Lake;

** Species not recorded in surveys previous to the damming.

Regarding the reptiles, six species were observed, which corresponds to 16.2 % of the total species recorded during the damming period. Among them, the Yellow-Spotted Amazon River Turtle (*Podocnemis unifilis*) is currently categorized as vulnerable according to IUCN (2007). However, like all other species here reported, it is believed that its populations do not suffer threats in the reservoir due to the large dimensions of the lake and the low hunting pressure, since it is a biological reserve. The Black Caiman (*Melanosuchus niger*) was recorded in the ReBio Uatumã management plan and was also recorded in this study, but it was not included on the pre-damming fauna list (ELETRO NORTE/CNPq/INPA – *Preservação e utilização científica da fauna. Relatório setorial. Julho-dezembro/1985*, unpublished data). This may be due to the fact that this species, at that time, was considered rare or in low density in the Uatumã River, but presently it

has benefited by the lake conditions after the damming of the river (R. Silveira, pers. comm.). According to Best (1984), this species prefers lentic waters such as *várzea* lakes and *igapó* forest, and due to the lack of hunting pressure in the reserve, it was probably able to increase its population size after the lake formation. However, density studies are recommended in order to obtain information regarding the population size of the Black Caiman in the ReBio Uatumã area.

According to dos-Santos (2003), fauna and flora surveys are the first steps for the conservation and rational use of a certain area. Although the results here presented are preliminary, they are certainly an important contribution for the consolidation of the ReBio Uatumã management plan and contain information that can be used for conservation actions in hydroelectric reservoirs throughout Amazon.

LISTS OF SPECIES

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